

Notes on Chromosomes of Japanese Pteridophytes (4)

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New chromosome counts are reported for nine species; *Acrostichum aureum* ($2n=119$, $4x$ -aneupl.), *Angiopteris palmiformis* ($2n=80$, $2x$), *Cheiropleuria bicuspis* ($2n=232$, $4x$), *Lunathyrium lasiopteris* ($2n=240$, $6x$), *Marsilea crenata* ($2n=40$, $2x$), *Pseudophegopteris bukoensis* ($2n=62$, $2x$; $2n=93$, $3x$), *Pteris laurissilvicola* ($2n=58$, $2x$ -apog.; $2n=87$, $3x$), *Pteris oshimensis* ($2n=58$, $2x$ -apog.), *Thelypteris laxa* ($2n=136$, $4x$). The basic chromosome number of *Cheiropleuria* is presumed to be $x=58$, which is cytologically peculiar in the order Dipteridales sensu Lovis.

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In this paper, the somatic chromosome numbers of nine species are reported. Voucher specimens are preserved in the Herbarium of the Natural History Museum and Institute, Chiba (CBM). Scientific names are in accordance with Nakaike, New Flora of Japan; Pteridophyta (1982), as in the preceding parts.

39) *Acrostichum aureum* L.

$2n=119$ ($4x$ aneupl.): Iriomote Isl., Okinawa Pref. (Voucher specimen: Nakato 1285, Fig. 1).

Previously reported as $n=30$ or $2n=60$ ($2x$) from Sri Lanka (Manton and Sledge 1954), Ghana (Manton 1959), India (Abraham et al. 1962), Jamaica (Walker 1966), Congo (Dujardin and Tilquin, in Löve 1971), and as $2n=120$ ($4x$) from Iriomote Isl., Japan (Kawakami 1979). This species is pantropical and grows in coastal mangrove swamps. The present material clearly showed $2n=119$ in all the three nuclear plates examined, which certainly represents an aneuploidal reduction from the eutetraploid of $2n=120$. The diploids have been known from both the Old and New Worlds, whereas the tetraploids known at present only from Iriomote Isl.

40) *Angiopteris palmiformis* (Cav.) C.Chr.

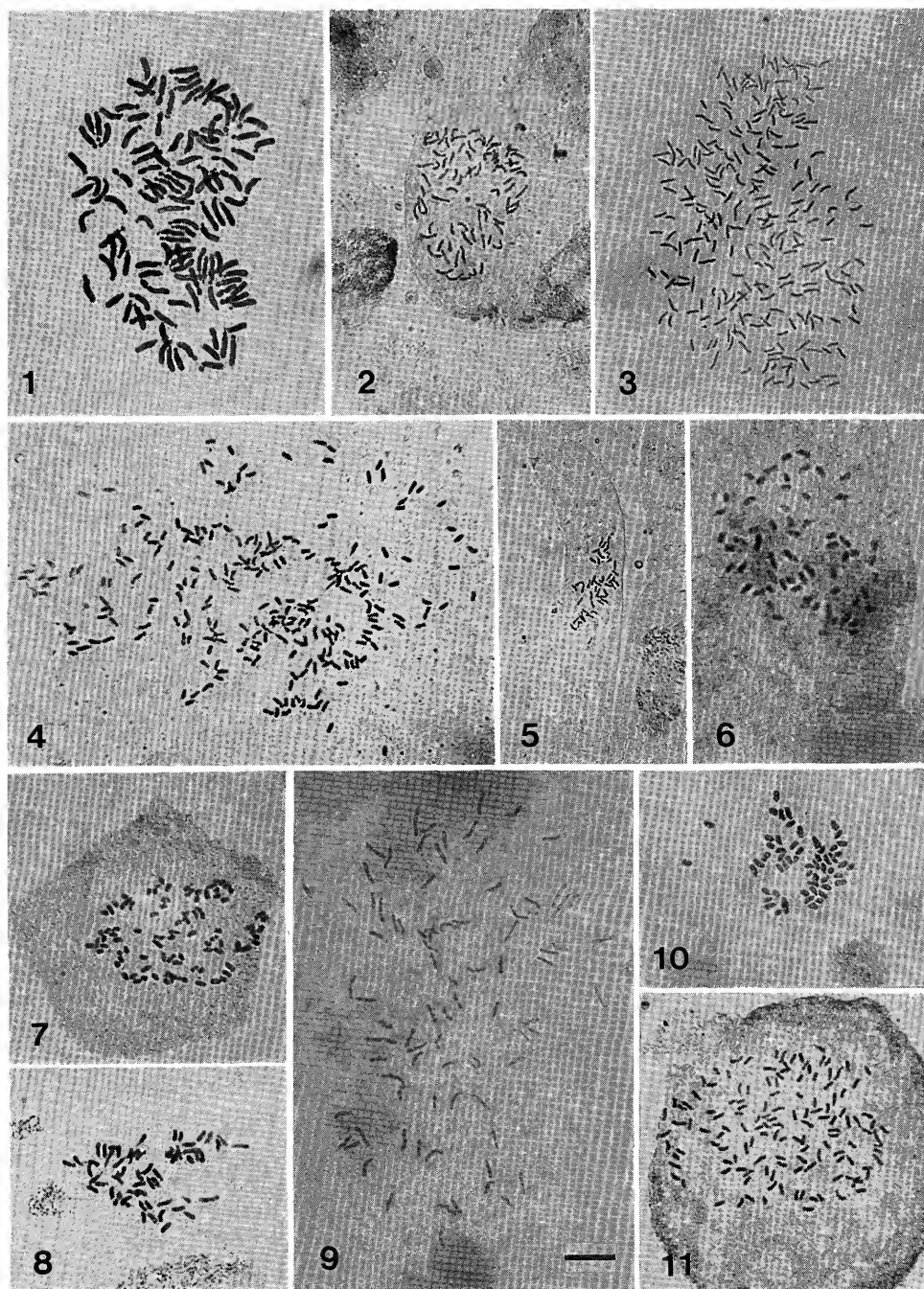
$2n=80$ ($2x$): Iriomote Isl., Okinawa Pref. (Nakato 1813, Fig. 2).

The chromosome number of this species is recorded for the first time. Out of the three Japanese species of *Angiopteris*, two species, *A. palmiformis* and *A. lygodiifolia* Rosenst., are characterized by having false veins running downwards from the sinus between two marginal teeth of pinnules. The former species can be distinguished from the latter by its long false veins extending nearly to the midrib (Nakaike 1982, Iwatsuki 1992). The present material of *A. palmiformis* was found to be diploid with $2n=80$, which is the same as in *A. lygodiifolia* having short false veins (Nakato 1988).

41) *Cheiropleuria bicuspis* (Bl.) Presl

$2n=232$ ($4x$): Amami-oshima Isl., Kagoshima Pref. (Nakato 1622, Fig. 3).

Previously reported as $n=c.57$ (without locality) (Walker 1984). The report of $2n=66$ in de la Sota (1973) and Löve et al. (1977) is erroneous (see Lovis 1977, p. 415).



Figs. 1–11. Photographs of somatic chromosomes. 1. *Acrostichum aureum*, $2n=119$. 2. *Angiopteris palmiformis*, $2n=80$. 3. *Cheiropleuria bicuspsis*, $2n=232$. 4. *Lunathyrium lasiopteris*, $2n=240$. 5. *Marsilea crenata*, $2n=40$. 6. *Pseudophegopteris bukoensis*, $2n=62$. 7. *Pseudophegopteris bukoensis*, $2n=93$. 8. *Pteris laurisilvicola*, $2n=58$. 9. *Pteris laurisilvicola*, $2n=87$. 10. *Pteris oshimensis*, $2n=58$. 11. *Thelypteris laxa*, $2n=136$. Scale in Fig. 9: 10 μm . All photographs are at the same magnification.

This species is a sole member in the family Cheiroleuriaceae, which is distributed in Indo-China, Sumatra and Borneo, east to New Guinea and north to Japan through southern China. From the report of $n=c.57$ by Walker (1984), the $2n=232$ plant observed in this study is undoubtedly of polyploid origin and the basic chromosome number can be presumed to be $x=58$. Thus, the plant reported by Walker (1984) is regarded as a diploid, and the present plant as a tetraploid.

The genera of Dipteridales sensu Lovis (1977), in which Dipteridaceae, Cheiroleuriaceae, Polypodiaceae and Grammitidaceae are included, show basic chromosome numbers of $x=33, 35, 36$, and 37 , excepting *Pleopeltis* (including *Lepisorus*) which possesses aneuploid numbers such as $x=22-26$ and 47 in addition to $x=35$ and 36 (Mitui 1971, Lovis 1977). It is noteworthy that the basic chromosome number of $x=58$ presumed for *Cheiroleuria* is very different from those of all the other members of Dipteridales. The highest chromosome numbers so far recorded in this group are $n=111$ in *Polypodium* (Manton 1950, etc.) and $2n=216$ and $n=108-111$ in *Pyrrosia* (Abraham et al. 1962, Manton and Sledge 1954), all these being at the hexaploid level of ploidy. Accordingly the chromosome number of $2n=232$ observed in *Cheiroleuria* is the highest at present known in the order Dipteridales sensu Lovis.

42) *Lunathyrium lasiopteris* (Kunze) Nakaike (= *Deparia dimorphophyllum* (Koid.) M. Kato)

$2n=240(6x)$; Itsukaichi, Tokyo Pref. (Nakato 1900, Fig. 4).

Chromosome number of this species was determined for the first time. Because the present specimen produced 64 spores per sporangium, the reproductive manner is considered to be sexual. An allied species, *L. japonicum* (Thunb.) Kurata, has also been reported to be sexual hexaploid with $n=120$ (Kurita 1960, Mitui 1968).

43) *Marsilea crenata* Presl

$2n=40(2x)$: Ishigaki Isl. (Nakato 1799) and Iriomote Isl. (Nakato 1801, Fig. 5), Okinawa Pref.

Previously reported as $n=42$ from Taiwan (Tsai and Shieh 1983). Since the basic chromosome number of the genus *Marsilea* is $x=20$ (Lesko 1994), the two plants examined in this study are diploid and the plants with $n=42$ from Taiwan is probably regarded as an aneuploid derived from $2n=40$. The chromosomes observed were very small and their sizes range in length from $1.6\ \mu\text{m}$ to $2.0\ \mu\text{m}$ in Fig. 5.

44) *Pseudophegopteris bukoensis* (Tagawa) Holttum (= *Thelypteris bukoensis* (Tagawa) Ching)

$2n=62(2x)$; Norikura-kogen, Nagano Pref. (Nakato 1703, Fig. 6).

$2n=93(3x)$; Shokawa-mura, Gifu Pref. (Nakato 1954, Fig. 7).

Previously reported as $n=30\pm1$ (Kurita 1960), $n=31$ from Zyumonji-toge, Nagano Pref. (Hirabayashi 1969) and Togakushi, Nagano Pref. (Mitui 1980). The triploid plant is found for the first time.

45) *Pteris laurisilvicola* Kurata

$2n=58(2x)$: Aira, Kagoshima Pref. (Nakato 26, Fig. 8). Boroishiyama, Miyazaki Pref. (Nakato 1516).

$2n=87(3x)$: Boroishiyama, Miyazaki Pref. (Nakato 1506, Fig. 9).

This is the first chromosomal report for this species. The diploid plants should be apogamous in reproductive manner, because they produced about 32 spores per sporangium. In the triploid, spore formation could not be examined because of the lack of fertile leaves.

46) *Pteris oshimensis* Hieron.

$2n=58(2x)$: Owase, Mie Pref. (Nakato 28); Boroishiyama, Miyazaki Pref. (Nakato 1496); Sibisan, Kagoshima Pref. (Nakato 1532, Fig. 10; Nakato 1534).

Previously reported as $n=87(3x\text{ apog.})$ from Amami-oshima Isl. (Mitui 1967); $n=87(3x\text{ apog.})$ in var. *paraemeiensis* from Yunnan, China (Wang 1989). The diploid of this species is newly reported in this study. All the present plants should be apogamous in

reproductive type, since about 32 spores are observed in each sporangium.

Pteris laurissilvicola was first described by Kurata (1967) as species having morphologically intermediate characteristics between *P. kiuschiuensis* Hieron. and *P. oshimensis*. However, there have been known to occur some problematical plants which could not be assigned clearly to any of these species (Nakaike 1982). As stated above, both *P. laurissilvicola* and *P. oshimensis* are cytologically variable and includes diploid and triploid cytotypes. *Pteris kiuschiuensis* has been reported to be an apogamous diploid with $n=58$ (Mitui 1975). Plants with sexual reproduction have not been discovered in these species. Therefore, the three 'species' as a whole may be regarded as an apogamous diploid-triploid complex.

47) *Thelypteris laxa* (Fr. & Sav.) Ching

$2n=136$ (4x): Tsukubasan, Ibaraki Pref. (Nakato 2012; Nakato 2015, Fig. 11).

Previously reported as $n=72$ (4x) from Kikugawa, Shizuoka Pref. (Kurita 1963) and $n=36$ (2x) from Hangzhou, China (Weng 1985). The previous studies have reported that this species consists of the two cytotypes of diploid and tetraploid based on $x=36$. However the present tetraploid plants were found to be based on $x=34$. More detailed studies are needed for cytology of this species.

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Endnote

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中藤成実: 日本産シダ植物の染色体ノート(4)

9種の日本産シダ植物について染色体の観察を行った。ミミモチシダでは $2n=119$ が観察されたが、これはすでに報告されている $2n=120$ (4x)の異数体と考えられる。日本産のリュウビンタイ属には3種が知られているが、ホソバリユウビンタイはリュウビンタイとおなじ染色体数で $2n=80$ の2倍体であった。スジヒトツバ科で唯一の種であるスジヒトツバでは、すでに $n=c.57$ (産地言及なし)が報告されているが、奄美大島産のものは $2n=232$ であった。スジヒトツバには種内倍数体が存在すること、および染色体基本数は $x=58$ であり奄美大島産の個体は4倍体であることが

判明した。この染色体基本数はDipteridales中でスジヒトツバ科のみにみられる。セイタカシケシダはシケシダとおなじく $2n=240$ の6倍体であった。ナンゴクデンジソウ ($2n=40$, 2x), タチヒメワラビ ($2n=62$, 2x; $2n=93$, 3x), コハチジョウシダ (ハチジョウシダモドキ) ($2n=58$, 2x-apog.), ヤワラシダ ($2n=136$, 4x) では、従来知られていなかった染色体数が算定された。アイコハチジョウシダでは、 $2n=58$ (2x-apog.) と $2n=87$ (3x) が観察され種内倍数性があることがわかった。